Outcomes of Long Bone Fractures Treated by Open Intramedullary Nailing at the St Ann's Bay Hospital, Jamaica

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ABSTRACT

Between May 2001 to August 2004, 35 patients had open nailing of long bones. There were 40 fractures fixed. Of these 40 fractures, there were 25 femoral fractures, 11 were tibial fractures and 4 were humeral fractures. There were 33 (82.5%) closed fractures and 7 (17.5%) open fractures. In the group of patients with open fractures, there were two Grade I, two Grade II and three Grade IIIB. Seven (20%) patients were lost to follow-up; all of whom had closed fractures. The final analysis as it relates to complications was done using 28 patients with 32 fractures.

The majority of fractures healed without significant complication. All the patients with closed fractures went on to bony union. There was one non-union and three delayed unions. There were two infections (osteomyelitis) and this was from the open fracture cohort. This represents an infection rate of 28.6% in this cohort. Two (7.0%) patients had persistent pain and one (3.6%) patient had early removal of the nail because of failure of fixation.

The mean time from injury to surgery for the fractured femur was 15.5 (range 0–49) days; fractured tibia 24.4 (range 0–40), days and fractured humerus 41.5 (20–81) days. The mean hospital stay was 18.9 (range 9–37) days for patients with fractured femur; for fractured tibia, it was 20.5 (range 3–82) days and for fractured humerus, it was 22.7 (range 3–82) days. The mean postoperative stay was 4.1 (range 1–14) days for fractured femur, 4.5 (range 1–14) days for fractured tibia and 4.0 (range 1–10) days for fractured humerus.

The mean time to healing (consolidation) as defined by X-rays was 5.0 (range 3–11) months for fractured femur, 5.2 (range 3–11) months for tibia and 7.0 (range 6– 8) months for fractured humerus.

Keywords: Küntscher nail, long bone fractures, open intramedullary nailing

Resultados Clínicos de las Fracturas de Huesos Largos Tratadas Mediante Enclavijado Intramedular Abierto en el Hospital de Saint Ann's Bay, Jamaica

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RESUMEN

Desde mayo de 2001 hasta agosto de 2004, 35 pacientes recibieron reducción de fracturas de huesos largos mediante enclavijado a cielo abierto. Se produjeron 40 fijaciones de fracturas. De estas 40 fracturas, 25 fracturas fueron del fémur, 11 fueron de la tibia, y 4 del húmero. Hubo 33 (82.5%) fracturas cerradas y 7 (17.5%) fracturas abiertas. En el grupo de pacientes con fracturas abiertas, hubo dos fracturas de grado I, dos de grado II y tres de grado IIIB. El análisis final en cuanto a las complicaciones, se realizó con 28 pacientes con 32 fracturas.

La mayoría de las fracturas se curaron sin complicaciones significativas. Todos los pacientes con fracturas cerradas lograron finalmente la unión ósea. Hubo uno que no logró la unión y tres uniones retardadas. Se produjeron dos infecciones (osteomielitis), provenientes de la cohorte de fractura abierta. Esto representa una tasa de infección del 28.6% en dicha cohorte. Dos (7.0%) pacientes presentaban dolores persistentes, y a un (3.6%) paciente le fue retirado el clavo tempranamente debido a que la fijación falló.

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El tiempo promedio desde la lesión hasta la cirugía, fue de 15.5 días (rango 0-49) para la fractura del fémur; 24.4 días (rango 0–40) para la fractura de la tibia, y 41.5 días (20–81) para la fractura del húmero. La estancia promedio en el hospital fue de 18.9 días (rango 9–37) para los pacientes con el fémur fracturado; para la fractura de la tibia fue de 20.5 días (rango 3–82), y para el húmero fracturado fue 22.7 días (rango 3–82). La estadía postoperatoria promedio fue 4.1 días (rango 1–14) para el fémur fracturado, 4.5 días (rango 1–14) para la tibia fracturada, y 4.0 días (rango 1–10) días para los casos de fractura del húmero.

El tiempo promedio de sanación (consolidación) tal como lo definieron los rayos X fue 5.0 meses (rango 3–11) para el fémur fracturado, 5.2 meses (rango 3–11) para la tibia y 7.0 meses (rango 6–8) para el húmero fracturado.

Palabras claves: clavo de Küntscher, fracturas de huesos largos, enclavijado intramedular abierto

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INTRODUCTION

Although Gerhard Küntscher advocated closed intramedullary nailing of femoral shaft fractures, the technique did not become popular in the Americas until some two decades after his proclamation. Since the development of image intensifier, closed intramedullary nailing has been a constant in orthopaedic practice. Reference to open nailing in the literature is now the recommended treatment of open fractures, some pathological fractures, failed internal fixation needing implant removal and treatment of non-unions of long bones. All other diaphysial fractures of long bones are treated by closed intramedullary nailing. As early as 1972, Rascher *et al* reported 100% union with closed nailing of femoral fractures and many other authors have reported great success with this technique.

At the St Ann's Bay Hospital (SABH) open intramedullary nailing with the Küntscher's nail is used routinely to treat fractures of long bones due to lack of facilities. There is a suggestion in the literature that the opening of the fracture site leads to a higher rate of infection and other associated complications (4, 5).

Since Gerhard Küntscher's first cloverleaf design was introduced in the early 1940s, intramedullary nail geometry has become increasingly complex. Many design changes have been introduced, and these have had profound effects upon the mechanical performance of intramedullary devices. This paper is not a comparison of fixation methods and their complications; it is a review of the open method of treatment of fractures.

SUBJECTS AND METHODS

The records of patients with fractures of the femur, tibia and humerus that were treated with intramedullary nailing at the SABH from May 2001 to August 2004 were retrospectively analysed. The criteria for inclusion were satisfied when the patient had clinical and radiological confirmation of the fracture and received surgical management by open intramedullary nailing for the condition along with follow-up until there was confirmation of consolidation on plain radiograghs. Once a patient was diagnosed with a fracture of a long bone and it was treatable by intramedullary nailing then it was scheduled for nailing. The patients underwent open intramedullary nailing of their fractures and all patients were given 1 gram of a second generation cephalosporin as prophylactic antibiotic in the peri-operative period. Patients with open fractures had wound debridement and irrigation with at least 3 litres (L) of normal saline and intramedullary nailing was done if it was deemed fit based on the level of contamination at the time of injury.

Three patients (four fractures) of the thirty-five patients were lost to follow-up, and a further four patients who had documented clinical and radiological union of their fracture were not available for final assessment of their symptom level and satisfaction with the treatment. Due to this loss of patients at follow-up, twenty-eight patients with thirty-two fractures were available for assessment of their complications. The notes were evaluated for records of persistent pain, infection deep or superficial, delayed unions, non-union and failure of fixation. The Gustilo Anderson classification of open fractures was used to classify the open fractures.

RESULTS

There were 35 patients with 40 fractures. The mean age was 36 years (range 11– 80 yrs). There was a male:female ratio of 3.4:1 (Fig. 1). There were 25 patients with fractured femurs, 11 with fractured tibias and 4 with fractured humeri (Fig. 2). There were 33 patients who had closed fractures and 7 patients with open fractures that had surgical fixation (Fig. 3). In the open fracture group, using the Gustillo Anderson classification system there were two Grade I, two Grade II and three Grade IIIB (Fig. 4).

The mean time from injury to surgery for fractured femur was 15.5 (range 0–49) days. Patients who had fractured tibia had a mean waiting time of 24.4 (range 0– 40) days and those with fractured humerus a mean waiting time of 41.5 (20–81) days (Fig. 5). The mean hospital stay for patients with fractured femur was 18.9 (range 9–37) days. Patients who had fractured tibia had a mean hospital stay of

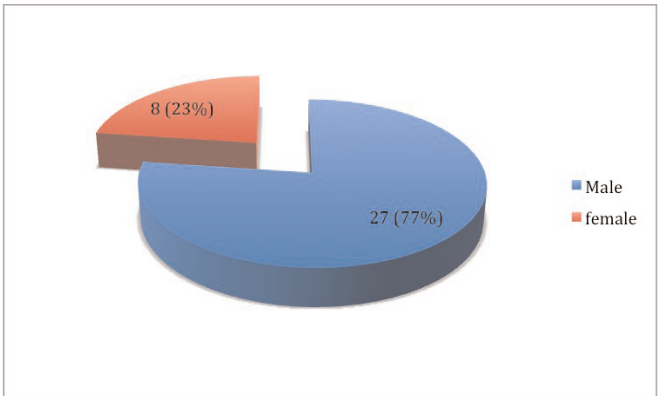

Fig. 1: Male:female ratio.

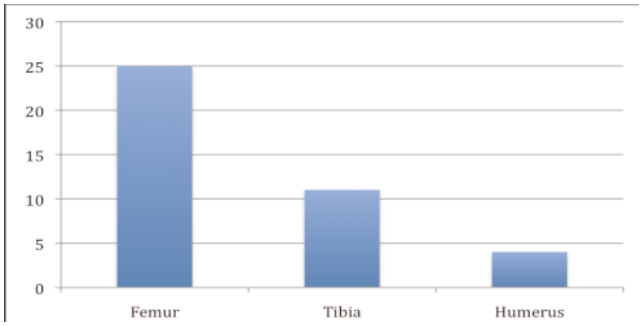

Fig. 2: Number of patient *vs* bones fractured.

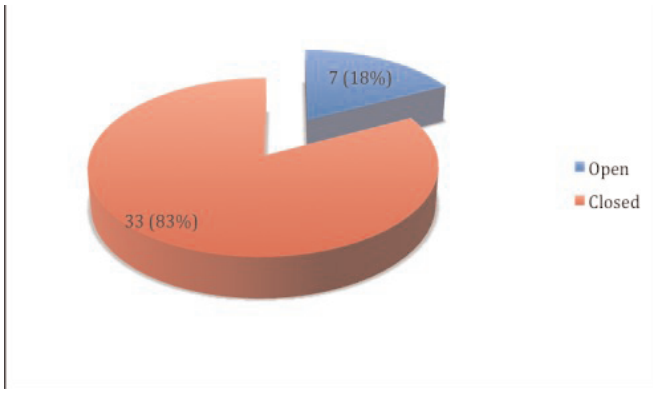

Fig. 3: Closed *vs* open fractures surgically fixed.

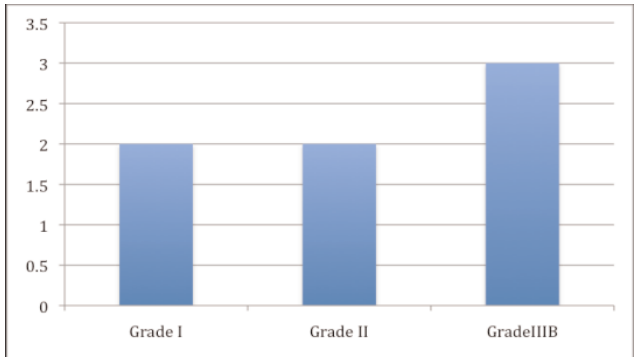

Fig. 4: Comparison of the Gustilo-Anderson grades of open fractures fixed surgically

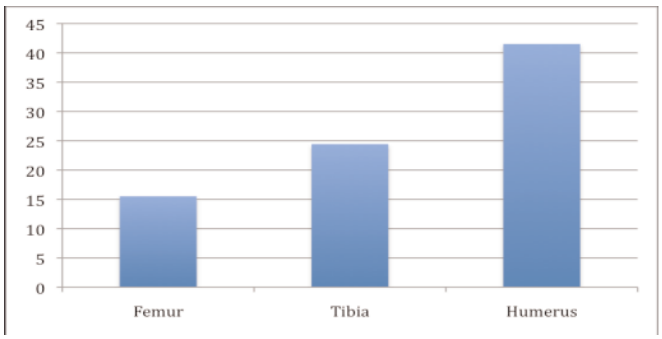

Fig. 5: Mean time from injury to surgery

20.5 (range 3–82) days and those with in hospital fractured humerus a mean stay of 22.7 (range 3–82) days (Fig. 6).

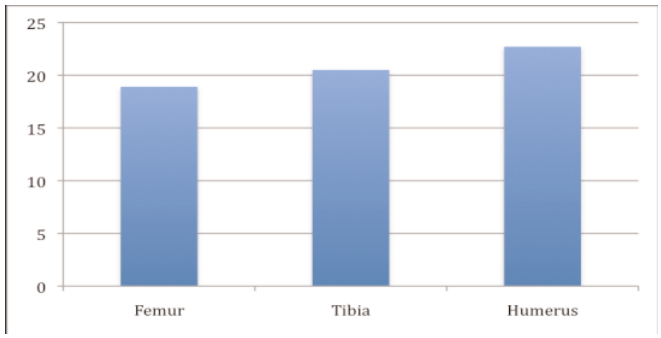

Fig. 6: Mean hospital stay

There was a mean postoperative stay of 4 days for all cohort of patients (Fig. 7). For patients with fractured femur, there

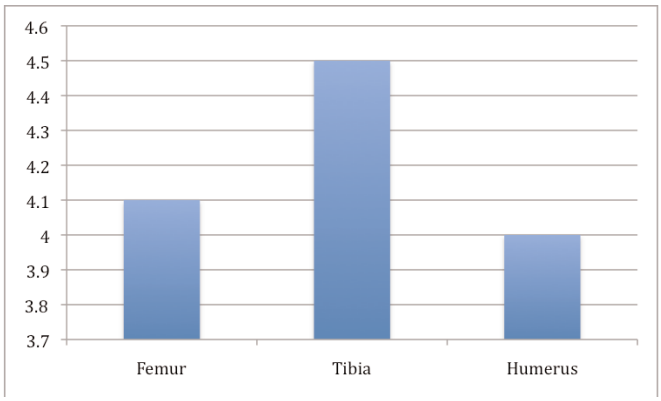

Fig. 7: Mean postoperative stay.

was a mean of 4.1 (range 1–14) days. Patients with fractured tibia had a mean of 4.5 (range 1–14) days and those with fractured humerus a mean of 4.0 (range 1–10) days.

The mean time to fracture consolidation 5 months for fractured femur (range 3–11 months), fractured tibia was 5.2 (range 3–11) months and fractured humerus was 7.0 (range 6–8) months (Fig. 8).

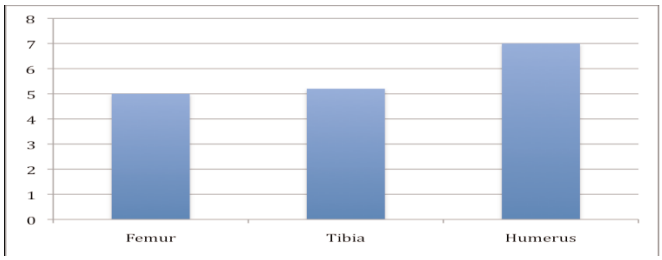

Fig. 8: Mean time to fracture consolidation.

There was a 31.3% rate of complication and this includes all the various possible complications that were reviewed as outlined above. The list is outlined below: two infections, three persistent pain, one early removal (failure of fixation), three delayed union, one non-union.

There were two infections in the 40 fractures treated by open nailing; this is a 5% rate of infection in the overall group. If these results are separated, then one will see that there were two infections in the group of open fractures who had immediate wound irrigation and intramedullary nailing which is a 28.6% rate of infection in that cohort. There were no infections in the closed fracture group who had the same procedure done.

The rates of other complications were minimal with three cases of persistent pain, 7.5% of the overall patients; one case of implant failure which leads to a non-union and three cases of delayed union.

DISCUSSION

At this centre, open reduction for the fixation of long bones undergoing intramedullary nailing are used routinely due to lack of facilities. During the period under review, there was a 31.3% overall complication rate in the 32 fractures seen at final assessment with only a 6% infection rate; all infections occurred in patients who had open fractures which is usually the greatest concern for this group of patients.

If the open fractures are removed from the sample and the rest of patients analysed, then there was 0% infection rate for closed fractures treated by the method of open intramedullary nailing. Tang *et al* reviewed 119 patients with tibial fractures of which 40 had open reduction of their tibial fracture and they found a 5% infection rate in the open group which is not statistically significant. This is therefore an indication that the opening of the fracture site especially in difficult reduction will not lead to a significant rate of infection if the proper measures are taken. Furthermore, as can be seen from the present study, there were no infections in the group of patients with closed fractures treated by open nailing.

The discussion as to the rate of infection when the fracture site is exposed surgically has been controversial. Babin *et al* confirmed that nailing with open reduction for tibial and femoral fractures increases the infection rate to 5.7% and 3.5% respectively. They concluded that closed intramedullary nailing by Küntscher's method is considered to be sound treatment for the fixation of fractures of the shaft of the tibia, femur and humerus with an infection rate of less than 1% in closed fractures. We have found that with the routine used of prophylactic antibiotics and strict asepsis that the infection rate is comparable to the closed method even when the fracture site is opened to achieve reduction.

Malik *et al* in their series had an overall rate of deep infection and non-union of 3.8% and 14.2%, respectively. They found that open fractures were significantly associated with deep infection. They also concluded that opening of the fracture site was associated with greater complication rates. Our series had no deep infection in the closed fractures in which the fracture site was opened. We also found that there only 12% of our series had difficulty with union after intramedullary nailing, which is comparable to that of the above series. It is likely that they used a superior and more technologically advanced nail with closer attention to the biomechanical characteristics of the nail used, compared to the one used in our series. Also the overall infection rate of 6% in the present study is comparable to the above series even though infections were in the patients with open fracture which has a greater risk of infection (3).

The overall incidence of complication in 32 fractures available for final analysis was 31.3% and this includes all the possible complications reported with this method of nailing. It should be noted that because of the lack of rigid locking with the Küntscher's nail there is a higher rate of micro-motion at the fracture site and hence a greater incidence of non-union and delayed union (1).

Since Gerhard Küntscher's original cloverleaf design, intramedullary nail geometry has become increasingly complex. Many design changes have been introduced and these have had profound effects upon the mechanical performance of intramedullary devices. This is not a comparison of fixation method and its complications; it is a review of the open method of treatment of fractures of long bones. Therefore the timing of fracture consolidation, persistent pain and other minor complications which can be minimized by other fixation methods are not discussed in this paper.

Overall, even though the closed intramedullary nailing method for treatment of a long bone fracture is more cosmetically acceptable than the open method, open intramedullary nailing is relatively safe and can be used, when there are distinct indications, without significant increase in the rate of infection.

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